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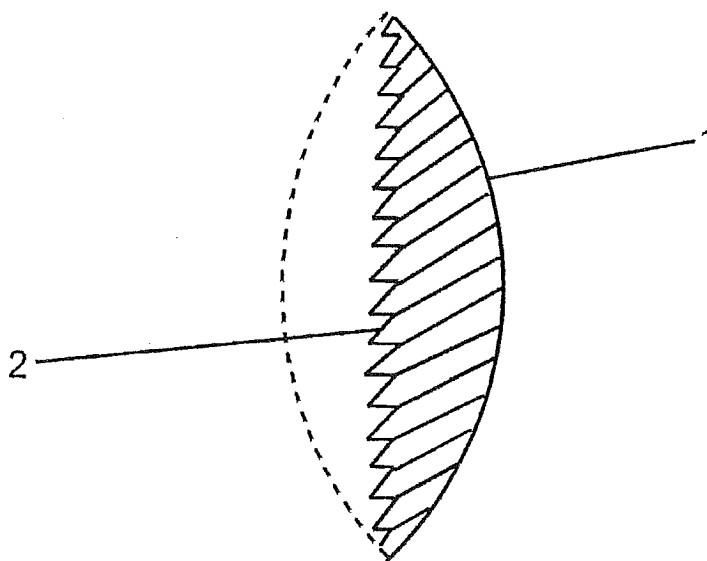
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(54) Title: INTRAOCULAR LENS



(57) Abstract: An intraocular lens comprises, as one face thereof, a Fresnel prism. Such a lens can be used for the treatment of a macular condition requiring a change of focus, e.g. age-related macular degeneration.

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— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTRAOCULAR LENS

Field of the Invention

This invention relates to an intraocular lens (IOL), and in particular to an intraocular lens that can be used to reduce the effects of age-related macular
5 degeneration (ARMD).

Background of the Invention

The treatment of focal macular diseases, and in particular ARMD, represents a major problem. Since the intact macula provides the vision that is required for reading, driving etc (but not for peripheral vision), the fact that there
10 is no effective treatment for its degeneration means that many people increasingly retain peripheral vision only.

In order to solve this problem, it has been proposed that the retina should be moved. A more practical solution is to move the image from the macula to a point on the retina where there are healthy cells; although these cells may not
15 function as well as the macular cells, an adequate degree of vision may be retained. Among other things, this is proposed in US-B-6197057.

In particular, each of Figures 25, 27, 31 and 33 of US-B-6197057 discloses a supplemental lens, i.e. an intraocular lens that is provided in addition to the natural, crystalline lens or to a biconvex IOL. All these drawings show a
20 supplemental lens that is a conventional prism. The consequence is that the image is moved, away from the macula. Elsewhere in the specification, it is suggested that a Fresnel lens should be used as the supplemental IOL (column 9 line 13), and also that the lens should be "fresnel-shaped" (claim 14; again, this is in the context of a supplemental lens). It is unclear what form the "fresnel-
25 shaped" lens should take.

Summary of the Invention

The present invention is based at least in part on the realisation that, while the treatment of ARDM requires removal of the crystalline lens, the focusing power of the IOL that is used instead can be provided by a conventional
30 lens, while that same lens can be modified so that light is focused on a (healthy) part of the retina that is not the macula. The present invention takes account of the fact that it would be undesirable to use a prism for this purpose, since that

would be unnecessarily bulky, and accepts that a Fresnel prism would not normally be used because of image degradation; the latter is a factor of relatively little importance if the macula is anyway degraded. According to the present invention, an intraocular lens comprises, as one face thereof, a Fresnel prism.

5 The novel lens provides the necessary features within a single unit. It is therefore easier to use and less bulky than any known IOL having the same function. It can be thin and light. Although it will degrade the image, this is a minor disadvantage and, in any case, the retina may not have good resolution.

Description of the Invention

10 The invention will now be illustrated by way of example only with reference to the accompanying drawing which is a schematic cross-sectional view of a lens embodying the present invention. The lens comprises what is essentially one half of a conventional lens, having a curved surface 1, and an opposed surface 2 in the form of a Fresnel prism.

15 A lens of the invention may be of conventional size and may be made of any suitable material. General characteristics of such lenses are known. The novel lens may be made of a rigid or hydrophilic material. Suitable materials are those used for intraocular lenses and include both hydrophobic and hydrophilic polymers containing acrylate and methacrylate such as polymethyl methacrylate,
20 and silicone elastomers such as dimethylsiloxane.

 If necessary or desired, a lens of the invention may include one, two or more haptics. As is known, they may be attached to the body of the lens at its perimeter, and may extend radially or tangentially.

 A lens of the invention will usually have only one power. A range of
25 lenses may be produced, each having a different power. Alternatively, "piggy-backing" may be used, by the provision of a supplemental lens that changes the power of a lens according to the invention.

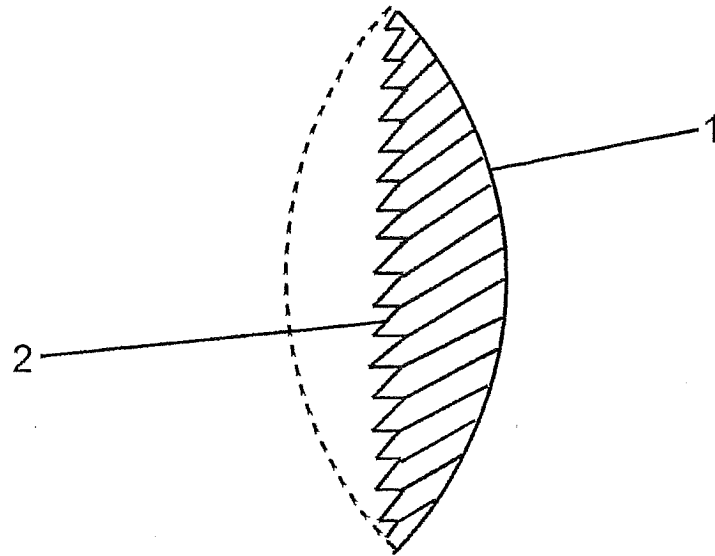
 The novel lens may be used in the eye, in either orientation, but it is generally preferred that a smooth face should face the posterior capsule. That
30 face of the lens having the Fresnel prism may be made smooth, by covering it with a translucent material (to the extent shown by the dotted line in the drawing).

The Fresnel prism component itself may have any of a variety of suitable designs. These include planar (flat disc), cylindrical (curved disc) and spherical (meniscus disc).

5 A lens of the invention may be used, following removal of the crystalline lens, for the treatment of any macular condition requiring a change of focus. The novel lens is particularly useful for treatment of ARMD. Its function may be visualised by substituting such a lens for the crystalline lens/IOL plus supplementary lens shown in Figures 25, 27, 31 and 33 of US-B-6197057.

CLAIMS

1. An intraocular lens comprising, as one face thereof, a Fresnel prism.
2. A composite intraocular lens comprising a lens according to claim 1 and also a material covering said one face, so that the composite lens has a smooth
5 surface.
3. A method for the treatment of a macular condition requiring a change of focus, which comprises replacing a patient's crystalline lens by a lens according to claim 1 or claim 2.
4. A method according to claim 3, wherein the macular condition is age-
10 related macular degeneration.



INTERNATIONAL SEARCH REPORT

In International Application No
PCT/GB 02/05360

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F2/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 828 558 A (KELMAN CHARLES D) 9 May 1989 (1989-05-09) column 4, line 9 - line 31; figures	1,2
X	US 5 135 592 A (MELVIN DONALD L) 4 August 1992 (1992-08-04) column 3, line 36 - column 5, line 45; figures 1,2	1,2
X	US 5 674 282 A (CUMMING J STUART) 7 October 1997 (1997-10-07) column 12, line 47 - line 51; figure 11	1
X	EP 0 458 508 A (IOLAB CORP) 27 November 1991 (1991-11-27) claim 15; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

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23/04/2003

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International application No.
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Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 3, 4
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

In International Application No
PCT/GB 02/05360

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4828558	A	09-05-1989	NONE	
US 5135592	A	04-08-1992	NONE	
US 5674282	A	07-10-1997	US 5476514 A US 5496366 A US 2001001836 A1 US 2001016771 A1 US 6197059 B1	19-12-1995 05-03-1996 24-05-2001 23-08-2001 06-03-2001
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